Editorial

External ophthalmic videography – Tools and techniques

Videography has become an integral part of modern ophthalmic microsurgery. Surgical videos are increasingly used to demonstrate and teach, to critically self-assess and learn, and to document and research. Video films are effectively used to train the residents and fellows and sensitize them to identify and manage intraoperative complications. The practical utility of video films to disseminate and popularize innovative surgical techniques among the peer group cannot be overemphasized. Video films are also effective and impressive patient education and practice-building tools.

Microscope-integrated and beam-splitter-based videography systems enable point-of-view (PoV) recording of cataract, glaucoma, and vitreoretinal surgeries. The use of two-dimensional (2D) and three-dimensional (3D) endoscopes for endonasal lacrimal and orbital surgery is well-established. However, routine videography of external ophthalmic surgeries of the eyelid, lacrimal system, orbit, and extraocular muscles, which conventionally are not performed on an operating microscope, can be logistically and technologically challenging. The basic need to set up an external video camera on a stable base for an uninterrupted view of the surgical field from several angles, dynamically adjustable for centering and constant monitoring of the quality of the recording, would necessarily involve a professional or a technically trained person. Over-the-shoulder and tripod-based camera positions have limitations in capturing all the vital surgical steps unobtrusively in a small operating field.

Early innovations in external ophthalmic videography attempted to make the surgeon self-sufficient and miniaturize the camera.[1] Mounting a camera on an overhead base such as the dome or the arm of a surgical light can provide a fixed, relatively unobstructed, top–down view of surgeries, but intraoperative centering can be difficult. Lin described an overhead setup using a modified GoPro Hero 4 camera (GoPro Inc., San Mateo, CA, USA) to record videos of an enucleation and a ptosis surgery.[2] The compact GoPro series of cameras are primarily designed to capture high-definition action sports videos.[1] As these cameras have a wide field of view in their standard form, they are bound to capture unwanted footage of the surroundings, especially if placed at a distance from the surgical field.[2] Lin fitted the GoPro camera with a custom lens for greater magnification and a narrower field of view and mounted it on the overhead surgical light using either a GoPro suction cup mount or a GoPro Jaws clamp and connected it to a computer monitor with an HDMI cable to allow for a live feed and online recording.[2] Maamari *et al.* used a modified GoPro Hero 3+ camera mounted on an overhead monitor.[3] The current issue of *Indian Journal of Ophthalmology* carries an article by Nair *et al.* that demonstrates the use of a video recorder mounted on a flexible tripod (Gorillapod®), fixed to a stand for external ophthalmic videography.[4] The authors emphasize that recorded videos were of high quality and the area of interest was in focus.[4]

PoV videography provides the surgeon's perspective using head-mounted cameras and novel, wearable technologies such as Google Glass.[1] Use of a head-mounted camera for PoV videography was demonstrated by Warrian *et al.* using a GoPro Hero 3+ camera mounted on a head strap.[5] Ho *et al.* used a GoPro Hero 4 camera connected in real-time by Bluetooth and GoPro App to an iPad (Apple Inc., Cupertino, CA, USA).[6] The practical barriers to PoV videography with head-mounted cameras are as follows: (1) extensive postproduction editing to center the frame and negate the effect of inherent intraoperative camera movements and (2) use of digital zoom to compensate for the wide-angle view of GoPro would compromise on the resolution. The Google Glass (Google LLC, Mountain View, CA, USA), innovative wearable technology with a head-mounted display with a built-in camera, provides the surgeon with total control to commence video recording by voice command and to monitor the video recording using a built-in glance-up

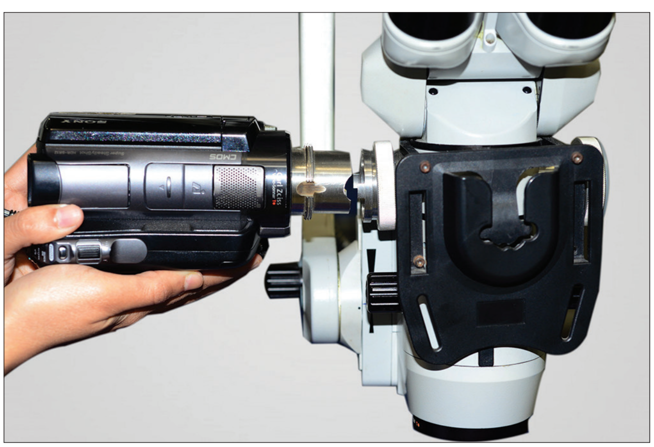

Figure 1: Operating microscope beam-splitter tube mounting of a video camera using a custom-made adapter. The front of the microscope shows an adapter to paraxially mount a 4K or a 3D camera

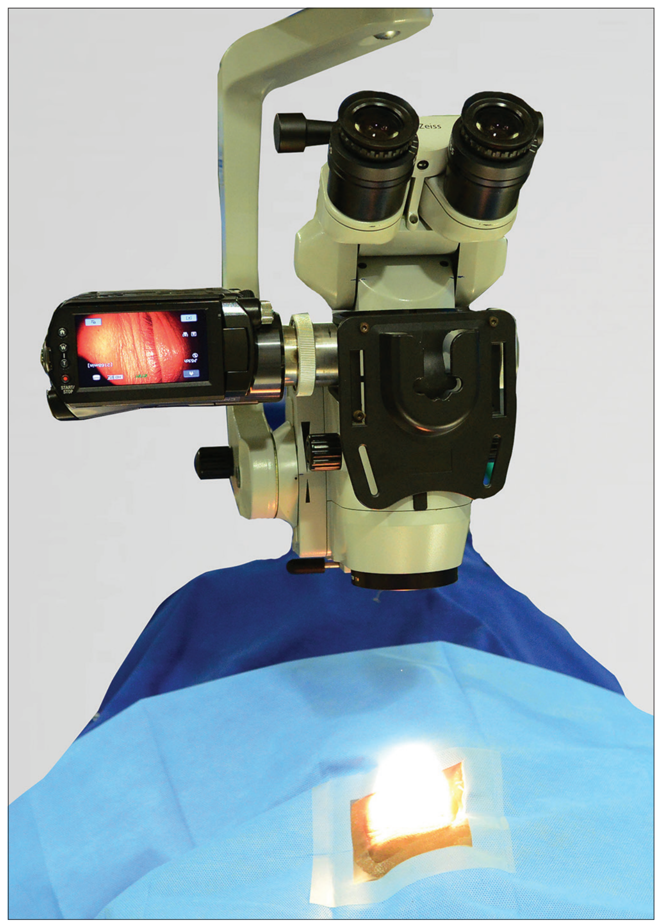

Figure 2: A video camera mounted on operating microscope beam-splitter tube, showing an extended field and working distance conducive for an oculoplastic surgery

Figure 3: 4K video camera mounted paraxially on the operating microscope, showing an extended field and working distance

display.[1] Rahimy and Garg have used the Google Glass to record a scleral buckle procedure.[7] Paro *et al.* have compared the Google Glass head-to-head with GoPro cameras.[8] Overexposure of the recorded video in the absence of an automatic white balance, wide angle, short battery life, and relatively lower resolution are the limitations of the Google Glass, and the lack of zoom function mandates extensive postproduction editing.[1] It remains to be seen whether or not the newer Glass Enterprise Edition (with longer battery life, a better camera, and customizability) is more suitable for ophthalmic surgery video recording.[1] Smartphones are increasingly used for surgical videography. "Smartphonography" surgical videos generally remain amateurish and, at best, semi-professional at this stage.

Procedures that require the use of surgical loupes are less suited to be filmed using the PoV techniques. Loupes need to be modified to be worn with Google Glass.[7,8] The surgeon's magnified intraoperative view will preclude monitoring of the quality of the recorded video.[7] Specialized cameras that are designed to be mounted onto loupes produce high-quality magnified videos but are not ergonomic due to the additional weight and constant intraoperative movements inherent to such systems. Nair *et al*. have described the effective use of a head-band mounted GoPro camera, independent of the surgical loupe.[9]

An ophthalmic operating microscope (with a 2.2 objective lens to increase the field of view and working distance) is ergonomically sound and is ideally suitable for eyelid, lacrimal, orbital, and squint surgeries.[10] We have been routinely using an operating microscope to record high-quality 4K 2D and 3D videos. The camera can be mounted either on to the beam splitter using a coupling device or fitted parfocal to the objective [Figs. 1-3]. It provides built-in illumination, variable magnification, focus control, and X–Y control and captures end-on, uninterrupted, well-framed, high-resolution, high-contrast, and surgeon's exact PoV videos, which need only minimal framing and editing.[11,12] The future seems exciting with heads-up 3D surgical visualization systems and extracorporeal digital operating microscopes (exoscopes),[13,14] which are being actively explored for use in ophthalmic plastic surgery, their cost being the only major barrier.

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